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Ontogenetic Development of *Perlohmannia gigantea* (Aoki, 1960) I. Morphology of Larval Stase (Acari: Cryptostigmata)

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Synopsis

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The genus *Perlohmannia* contains five species and a single form, but immature forms have hitherto been known on two species, *coiffaiti* and *dissimilis*. In the present paper I describe larval stase of *gigantea*, comparing it with the two species. Among *gigantea* and the two species only the number of apoteles in adult is the disticnt difference, but in the larval stase several apparent distinguishing characters of *gigantea* are brought by the present study: (1) the absence of *PY*, (2) the absence of pseudoanal seta, (3) the shape of h_1 is not hook-like, (4) the differece in the palpal and pedal chaetotaxies and (5) the absence of (*p*) in TR II and III.

This paper presents morphology of the immature stase of *Perlohmannia gigantea* which was described by AOKI (1960) based on adults as the type species of the genus *Apolohmannia*.

In 1969, FUJIKAWA and AOKI accepted GRANDJEAN's opinion (1961) and treated the genus as the synonym of the genus *Perlohmannia*.

Up to now we know five species and one form of the genus *Perlohmannia*, but the juvenile forms are only described on *P. dissimilis* and *P. coiffaiti* by GRANDJEAN (1958 and 1961).

As the first report on the series of morphology of *P. gigantea*, I describe the larva which has interesting characters.

The specimens used in the present study were collected by Mr. M. TAKANO (Tsurumi High School, Kanagawa-kén) from Mt. Hakugin-zan, Hakoné, Kanagawa-kén.

I wish to express here my thanks to Mr. TAKANO for his offering a good series of the specimens.

I. DESCRIPTION OF LARVA

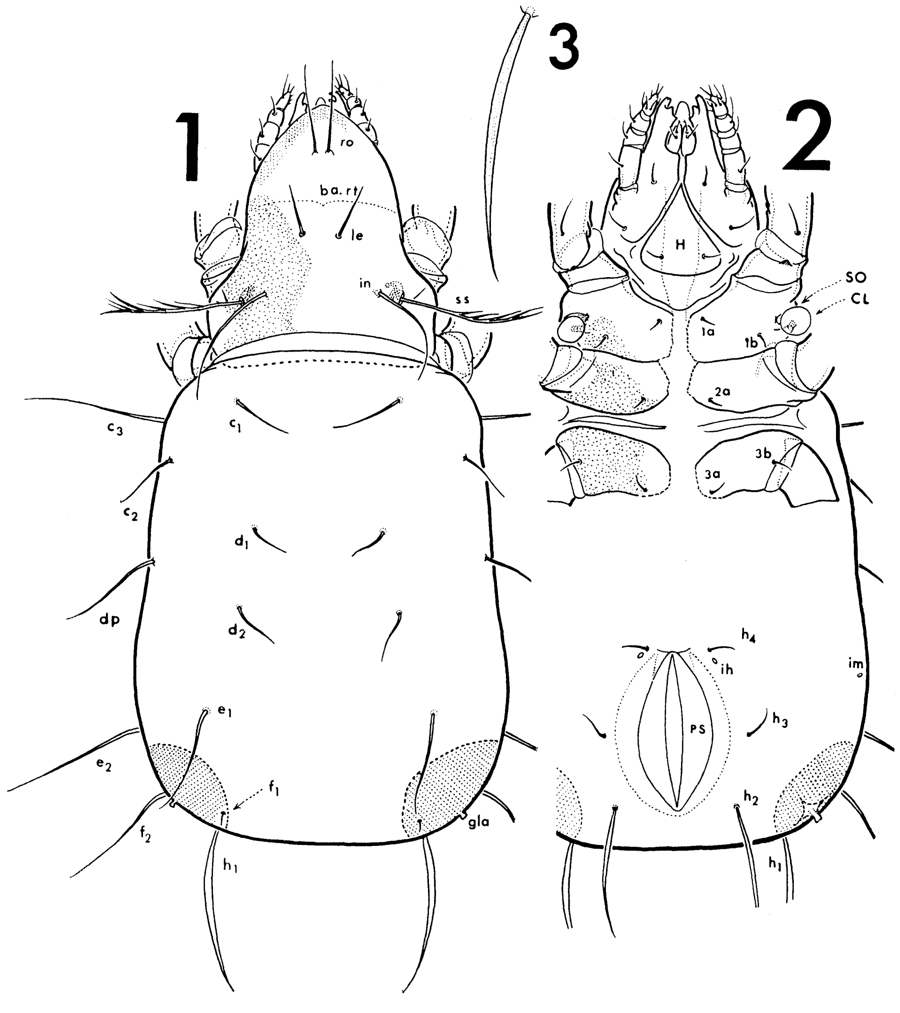
Locality.—Mt. Hakugin-zan, 800 m above the sea level, Hakoné, Kanagawa-kén, Central Japan, 23-IV-1972; leg. M. TAKANO.

Materials.—Eight larvae separated from litter samples.

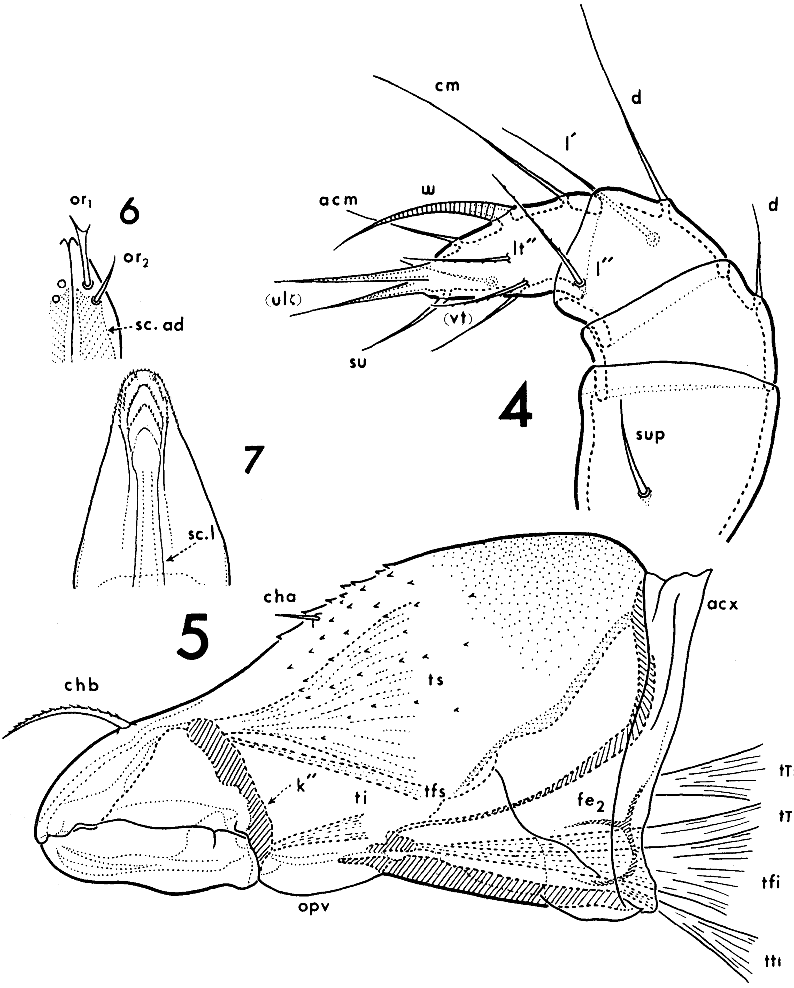
Measurement.—Length: 455 (465) 475 μ; width: 215 (225) 240 μ.

Habitus, colour and cuticle.—Hexapod larva. Hysterosoma rather rectangular like in adult; posteriormost part of hysterosoma cut off (Fig. 11), so that the posterior margin of the body rather straight in dorsal view (Figs. 1 and 2). Sclerotization well developed in coxisternal region, on legs and in a part of infracapitulum which are brown in colour, while in aspidosoma, even in sclerotized parts, cuticle not so coloured except for the lateral border of rostrum *nlbo* which is well sclerotized and deep blackish brown (Fig. 9). Borders of each sclerotized part inconspicuous in contrast with those of adult, but lateral border of aspidosoma, namely abjugal border, distinct; the distinct abjugal border becomes obscure near aspidosomal gland *ga* (Fig. 9). Lateroabdominal gland well coloured like in Trhypochthoniidae. In any sclerotized cuticle porous structure can be recognized, being the same type as that of higher oribatid cuticle (Figs. 1, 2 and 9). Along the lateral margin of rostrum its cuticle striated longitudinally (Fig. 9); the striae not found on the exterior surface of rostral tectum, but on the inner surface.

Gnathosoma.—Infracapitulum sternarthry. Mentum *mn* or *H* triangular in shape, having a single pair of smooth seta *h*. Rutellum *RU* narrow and has several dents which are separated into two groups (Fig. 2); *RU* not enough coloured, being rather semitransparent, but near incision *af* small area coloured with brown. Gena *G* has two pairs of smooth setae *a* and c, almost equal in shape and length; *m* located at the basal part of palpal trochanter. Lateral lip *LL* colourless and smoothly continues to *G*; *LL* has two pairs of conspicuous adoral setae or_1 and or_2, being provided with poorly developed adoral sclerite (Fig. 6) which is coloured with pale brown and never plate-like. The adoral seta or_1 remarkable in its shape: the seta has a bifid head and a rather thick stem, but has never ciliae on its surface. Superior lip *LS* also transparent and has many minute sharp teeth on the dorsal anterior portion like in adult *dissimilis*. Each tooth beset on several strata (Fig. 7) in which the top has a weak sclerotized narrow tail *sc. l* which extends posteriorly. Ventral surface of *LS* striated transversely, but has no *rv*. Chelicera of *gigantea* stouter than that of *dissimilis*; dorsal surface provided with minute dents, a spiniform



Figs. 1–3. Larva of *Perlohmannia gigantea*
1) Dorsal side: profile of larva well resembles that of adult, but sclerotization of hysterosoma and coxisternal region is poorly developed. Cuticle of aspidosoma is well scerotized like in adult, being blackish brown, while hysterosomal and coxisternal cuticle is softer and paler than aspidosomal one; aspidosomal tectum is punctured with minute pits as in coxisternal cuticle (Fig. 2), in Fig. 1 the punctuation is partly drwan. 2) Vental side: bottum of CLAPARÈDE's organ *CL* is drawn in this side being not flat, but is rather concave; basal part of *CL* continues to *a.c.* II, being never articulated with *a.c.* II. Around pseudoanal lips *PS* an indistnict line, broken line in figure, can be detected through the body, it seems to be an border of adanal segment *AD* which will emerge in protonymphal stase (n_1). 3) Gastronotic seta h_1: in the setal series of *h*, h_3 and h_4 are ordinal setiform, but h_1 and h_2, especially h_1, are rather wide in middle like a leaf of monocotyledon.

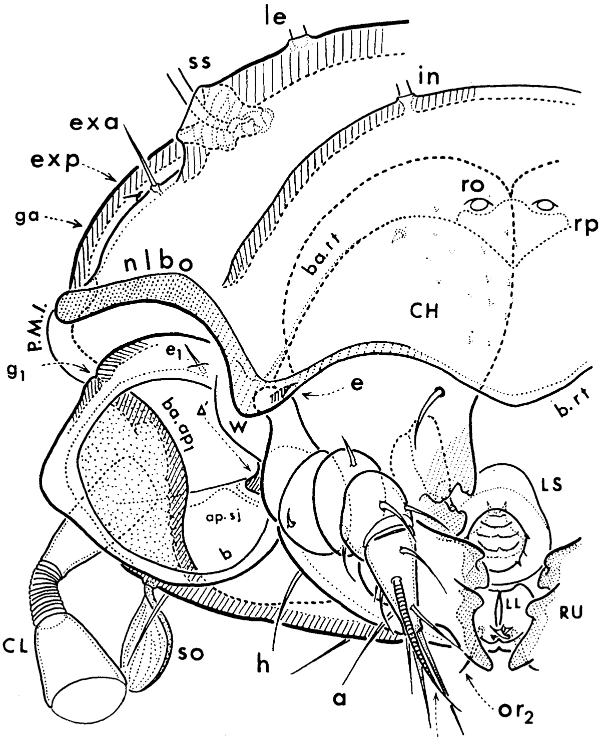


Figs. 4–7. Components of infracapitulum and chelicera of larva of *Perlohmannia gigantea*

4) Left palp: ultimal setae (*ulζ*) are ceratiform, having a common thick base, while subultimal *su* is thin and ordinal seta; in this figure trochanter and a part of femur are omitted. 5) Left chelicera: dorsal and laterodorsal sides of the principle cheliceral segment has minute sharp spines which distribut on antiaxial side; micropits are able to determined on antiaxial side, but the pits are obscure near ventral side. 6) Ventral view of lateral lips *LL*: adoral scelrites *sc. ad* very pale and indistinct. 7) Dorsal view of labrum *LS*: anterior portion of *LS* has many minute dents which compose several starta. The top of the strata is somewhat hard.

Figs. 8–10. Larva of *Perlohmannia gigantea*

8) Frontal view of propodosoma: rostrophragma *rp* is small and triangular in shape, being somewhat wider than the mutual distance *ro-ro*. Apodema I ap_1 is large and has porous structure on its surface. 9) Lateral view of podocephalic region and a part of aspidosoma: strong thickening of cuticle can be detected along the border of aspidosoma, being indicated by the letter *nlbo*. Supracoxal spine *e* of palp is not "seta", but is continuantion of infracapitular cuticle. A part of aspidosomal reciculation is only drawn in this figure. 10) Protective seta *SO* and a basal part of CLAPARÈDE's organ *CL*; protective seta *SO* is leaf-like and has indistinct longitudinal veins.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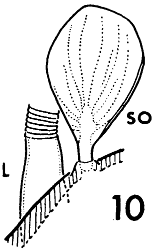
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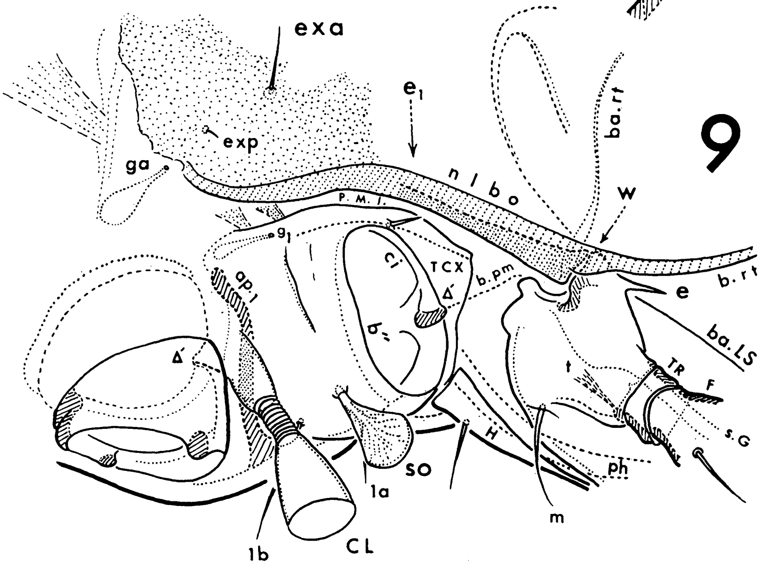
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cheliceral seta *cha* and ordinal seta *chb*. Microsculpture can be found on its surface. Palp rather short (Fig. 4). Each segment of palp not so well sclerotized and coloured, but sculptured with micropits. Palpal chaetotaxy which includes solenidion ω can be summarized as (0–1–1–3–10): tarsus has only two eupathidia $ul'\zeta$ and $ul''\zeta$ which have a common base for the insertion and well resemble in their shape and length. Setiform subultimal seta *su* situated on ventral side, being subequal in length to ventral seta *vt''*. Solenidion ω thick at the base and rather long; its tip extends beyond the distal end of *su*. Genu has a single short seta *d* on the dorsal side; the seta much shorter than tibial *d*. Femur provided with a single seta *sup*, having no *inf* in this stase.

Aspidosoma.—Rostrum ordinal form (Fig. 1); GRANDJEAN (1958) described several variations on the form in *coiffaiti*, while I could not detect the rostral variations in *gigantea*. Inner side of the tectum has many irregular longitudinal veins, which are found in the area anterior to *ba. rt* along the rostral margin. Five smooth aspidosomal setae *ro*, *le*, *in*, *exa* and *exp* present; relation in length of these setae as follows: $in > le > ro \gg exa \gg exp$. Rostral setae situated close together and never arranged longitudinally. Behind interlamellar seta a single transverse furrow *s* can be found, but the furrow not so conspicuous. Anterior exobothridial seta *exa* much longer than *exp*: *exa* located just beneath bothridium; *exa* situated near the border of aspidosoma (Fig. 6). Aspidosomal gland *ga* opens its orifice near *abj*, having a small sack. Sensillus *ss* exoclinate and has 4–5 short branches on the one side like in adult. The organ somewhat shorter than *in*, but equal in thickness. A synaptrich transversal band *SNT* can not be detected.

Lateral side of podosoma.—In podocephalic region a triangular zone *TCX* found

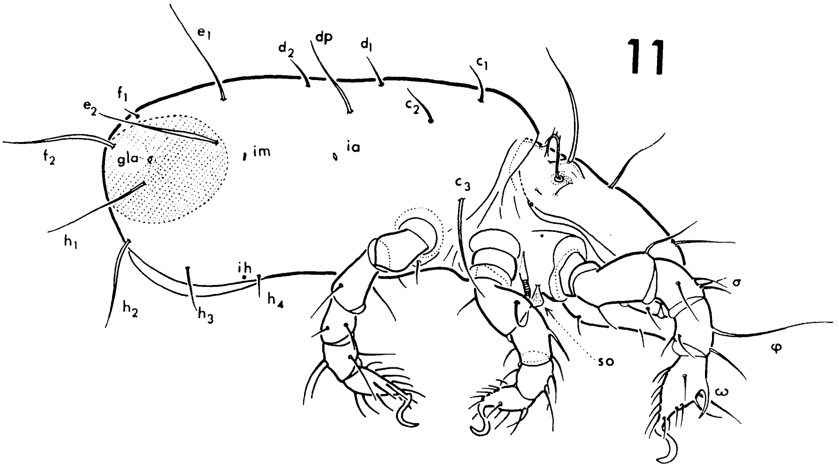

Fig. 11. Larva of *Perlohmannia gigantea* in lateral view; ω, φ and σ are pedal solenidia.

by dessecting and removing of the body wall and the leg I: The zone very narrow and poorly sclerotized; ventral end of *TCX* continues to the basal part of trochanter I, while dorsal end runs to the level of *exp* along *abj* and forms *bcx*. Posterior end of *bcx* faintly burnished in *P.M.I.*, so that *bcx* has not an angle *z*. A soft membrane *P.M.I.* very narrow (Fig. 9). Supracoxal spine e_1 of leg I short, being situated on rather paraxial part of coxal region. A very minute orifice of coxal gland g_1 situated on the posterior coxal region; an internal sack of the organ narrower and smaller than *ga*.

Gastronotic region.—Hysterosoma rectangular. There is no pygidium *PY*. Dark reddish brown pigmentation can be observed in lateroabdominal gland *gla*, opening of which is somewhat protruding (Figs. 1 and 2); the coloured area large like in *Trhypochthoniella*. Fourteen pairs of gastronotic setae classified into three groups: to the first group belong setae c_{1-2}, d_{1-2}, e_{1-2}, h_{2-4} which are normal filiform,[1] to the second group the seta h_1 which shows rather hypertrophic state, and to the last group very minute seta f_1. In the first group, centrodorsal setae c_1, c_2, d_1 and d_2 subequal in length and form, being almost 1/3 of e_1; f_2 and e_2 thicker than the remaining setae, but they are thinner than h_1 (Fig. 3) which is wide in the middle portion and becomes thin in basal and distal part like a leaf of monocotyledon. Ventral setae h_3 and h_4 shorter than the centrodorsal setae. The seta c_3 located near upper part of pedal acetabular region (Fig. 9). Lyrifissures *ia*, *im* and *ih* cup-shaped: *ih* opens just behind h_4 (Fig. 2).

Coxisternal region.—Coxisternal chaetotaxy (2–1–2), which excludes the protective seta *SO* for CLAPARÈDE's organ *CL*. Coxisterna I and II ordinarly close to each other, but coxistenum III separated from these coxisterna by a deep ventrosejugal furrow *vsj*. Apodemata I and II well developed like sternal apodema; ap_3 never developed and has no chitinous projection *w*. CLAPARÈDE's organ *CL* continues smoothly to acetabulum II (Figs. 2 and 9). Tectal scale or seta *SO* can be recognized on coxisternum I (Figs. 2 and 9). The organ *CL* well resembles that of *P. dissimilis*, consisting of three parts, namely, a basal cylindrical part, a bellows-like part and a distal fusiform part. Coxisternal cuticle slightly sclerotized, being porous like in aspidosoma (Fig. 2). Such a sclerotization and the surface structure can not be observed in sternal and ventrosejugal regions.

Paraproctal region.—In this stase only pseudoanal lips *PS* can be recognized, having neither setae nor their vestiges.

Legs.—Each leg well sclerotized like aspidosoma and coxisternal region. All the legs monodactylous. Each apotele smooth[2] and has a conspicuous projection *ht* at its

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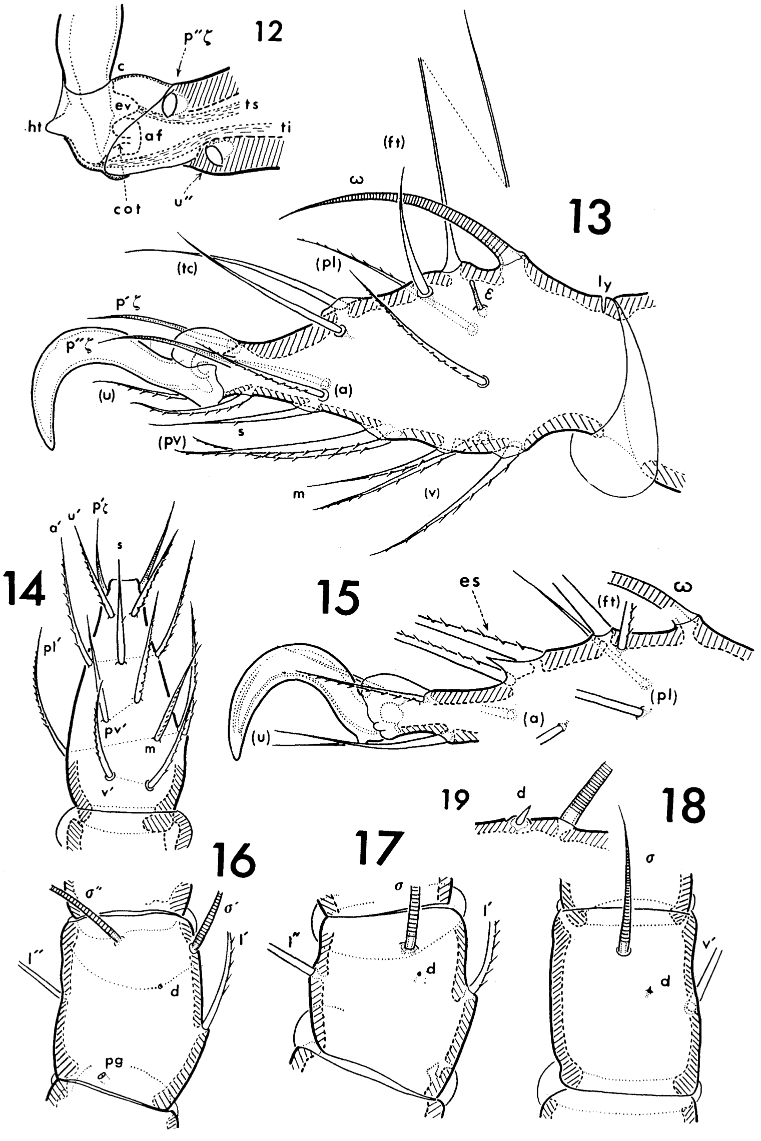
[1] The seta h_2 rather wide, but narrower than h_1.

[2] Among the specimens examined, only one specimen has several teeth on the dorsal side through all the legs.



Figs. 12–19. Larva of *Perlohmannia gigantea*

12) Basal part of apotele of left leg I: a hooklike projection can be found on each apotele; internal basal fragment of apotele is rather complex and consists of a tubercle *ev* and lamella *af* which is larger than *ev*. Superior tendon *ts* connects *ev*; inferior tendon *ti* attaches to the bottum of *af*. 13) Left tarsus I. 14) Ventral aspect of left tarsus I: dorsal setae and apotele are onitted. 15) Left tarsus II: in this stase proral setae (*p*) are absent, the setae perhaps emerge in the protonymphal stase. A single ceratiform cuticular projection *es* is distinct and characteristic on this segment. 16) Dorsal view of left genu I. 17) Dorsal view of left genu II. 18) Dorsal view of left genu III. 19) Lateral view of dorsal seta *d* and a part of solenidion *σ* of left genu III.

basal part (Figs. 12 and 15). Chaetotaxy as follows: I (0–2–[2+1 v]–4–19), II(0–2–[2+1 v]–5–15), III (0–2–[1+1 v]–3–14); solenidiotaxy: I (0–0–2–1–1), II (0–0–1–1–1), III (0–0–1–1–0).

Tarsus I has 19 setae. In this stase iteral setae (*it*) absent. Eupathidial setae only prorals ($p\zeta$). Setae (*ft*), (*tc*) and ($p\zeta$) smooth, but the remaining setae ciliated. Proral setae gently curved ventrally and never reaches the distal end of apotele. Paraxial fastigial seta ft' longer than antiaxial ft''. Subunguinal seta *s* has a single short cilia (Fig. 13). This species provided with ventral setae (*c*) and a monotrop seta *m*: (*c*) located at the basal area of this segment (Fig. 14), while *m* can be found in front of v''. Solenidion ω never piliform and has a very thick base which is somewhat protruding. The tip of ω extends beyond the base of (*tc*), but does not reach that of ($p\zeta$). Famulus ϵ short nad thick bacilinate with a guttiform head.

Tarsus II lacks proral setae. This state can be also found in tarsus III. Solenidion ω rather slender in contrast with ωI, but is not filiform. Eupathidial setae can not be recognized. Antiaxial iteral seta it'' has a distinct cuticular base *es* which is sharp and ceratiform (Fig. 15). Iteral and unguinal setae neither waved nor curled in their anterior portions.

In tarsus III the ceratiform projection of (*it*) absent, but a small rising of cuticle recognized in its setal base. Primiventral (*pv*) unpaired; only antiaxial pv'' located near pl''.

Tibial solendion φ filiform, but not so thin; φ longer than *d* which is erected and has no barbs. Solenidion φ never accompanied by *d*.

Genual setation remarkable: this segment has one, in *G*II and *G*III, or two, in *G*I, solenidion σ' or σ'' and two lateral setae (*l*), and has a vestigial dorsal seta *d*. The dorsal seta of *G*I and *G*II very minute[3] (Figs. 16 and 17); *d*I exists posteriorly to the level of σ'—σ'' (Fig. 16). All solenidia not associated with *d*. Antiaxial σ'I inserted on rather lateral side (Fig. 16); each solenidion slightly shorter than tibial one. An inconspicuous small pore can be detected on the dorsal posterior area of *G*I. The small pore may be genual pore which was discovered in *Collohmannia* (Grandjean, 1966). Chaetotaxy of *G*III shows the presence of a single solenidion σ, a single seta *v* and a vestigial *d*. Ventral seta v'III normal in shape and length, but dorsal *d*III solinent. The seta *d*III rather distinct in contrast with *d*I and *d*II (Figs. 16 and 17). The seta spiniform or pyliform and 1–1.5 μ in length, being never accompanied by σ. The length of *d*I and *d*II less than 1 μ. There are several individual variations in the presence of *d*: two specimens among eight have thin seta like *d*I and *d*II.

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[3] Vestigial setae are indicated with an abbreviation *v* in the chaetotaxies.

II. REMARKS

The genus *Perlohmannia* contains five species: *coiffaiti, dissimilis, gigantea, insignis, nasuta* and one form *nasuta D*. In these species and a form, morphology of larval stase has only been known in *coiffaiti* and *dissimilis* which were reported by GRANDJEAN (1958 and 1961), but the former was described more in detail than the latter. Therefor, in this remarks I compare mainly the larva of *gigantea* with that of *dissimilis* and partly with *coiffaiti*.

Remark 1.—ROSTRUM

Rostral tectum not so well developed, so that labri, rutella and palpi are partly exposed as in *P. dissimilis*. *P. dissimilis* varies in rostal shape: GRANDJEAN (1958) stated two forms, but in *gigantea* there is no variations. Rostral setae inserted transversely in *gigantea,* while *dissimilis* has a longitudinal arrangement. It seems that the position of *ro* well variable in most of *Perlohmannia*-species, but *gigantea* is constant in the arrangement in juveniels as well as in adults.

Remark 2.—HYSTEROSOMAL CHARACTERS

(1) *Hysterosomal shape*. *P. gigantea* rectangular, while the posterior part of *dissimilis* is well protruding posteriad with thick hook-like setae h_1.

(2) *Pygidial porosity*. Pygidial area of *dissimilis* is rather sclerotized and is roughly punctured, while *gigantea* has no pygidium and such a rough punctures.

(3) *Seta* h_1. The setal shape of *dissimilis* resembles that of *gigantea* except for h_1: h_1 of *dissimilis* is very thick hook-shaped, being inserted close to each other at the most posterior position of hysterosoma. In *gigantea* the seta is normal setiform, but wider than other setae; it resembles a leaf of monocotyledon.

Remark 3.—PARAPROCTAL REGION

Pseudoanal lip of *dissimilis* has one seta, while in *gigantea* no seta is present on the lip. Setal serieses *ps* and *ad* may be emerge in protonymphal stase.

Remark 4.—CHAETOTAXIES OF LEGS

(1) *Tarsus* I, II and III. Chaetotaxy of tarsus I of *dissimilis* shows 16 setae excepting solenidion ω, but *gigantea* has 19 setae: the difference is resulted from the absence of (v) and a monotrop seta *m* in *dissimilis*. In *coiffaiti* tarsus I[4] also suggests the lack of v', v'' and *m* like in *dissimilis*. It seems that the monotrop seta *m* is homologous to c'' of *coiffaiti* because of its position. Tarsus II and III lack (p) in *gigantea*.

(2) *Genual seta d*. In *gigantea* genual setae *d* of all the legs are vestigial as in *dissimilis*, but in the state *d*III rather long and thick (Fig. 18); *d*I and *d*II less than 1 μ

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[4] GRANDJEAN (1961) draw only nymphal pedal figures, but according to his figures and description it seems that larva of *coiffaiti* has no (v) and (c).

in length. In *dissimilis* *d* of genu less than 1 μ.

(3) $d\varphi$ and $d\sigma$. The association of *d* with φ or σ is absent in *gigantea*, but is present in *dissimilis*.

Remark 5.—PALPAL CHAETOTAXY

P. dissimilis has the palpal formula (0–1–0–3–8) excluding ω, while the chaetotaxy of *gigantea* is summarized as (0–1–1–3–9). In the latter species, the formula shows that genu has one rather short dorsal seta *d* and tarsus is provided with two ventral setae, but *dissimilis* has no vt''T. A minute subultimal seta *su* located at the dorsal side of the base of *ul'* in *dissimilis*, but the seta has the ordinal length, being inserted on ventral side and is separated from $(ul\zeta)$ in *gigantea*. Anteroculminal seta *acm* is not eupathidion like in *dissimilis*.

III. KEY TO LARVAE OF P. DISSIMILIS, COIFFAITI AND GIGANTEA

1.—Hysterosoma has a pygidial sclerite *PY* 2

—Hysterosoma has no pygidial sclerite *PY* .... *P. gigantea*

2.—*PY* covers posterior part of hysterosoma (dorsal, lateral and ventral sides) .... *P. dissimilis*

—*PY* exists only on dorsal side and not so large .... *P. coiffaiti*

IV. KEY TO ADLUT OF PERLOHMANNIID SPECIES

1.—Body length more than 830 μ 2

—Body length less than 800 μ 5

2.—Rostrum narrow and the tip has a sharp projection .... *P. insignis*

—Rostrum rather wide and has notches or has no notches 3

3.—legs tridactylous .... *P. gigantea*

—legs monodactylous 4

4.—Rostral setae arrenged transversely .... *P. dissimilis*

—Rostral setae arrenged longitudinally .... *P. coiffaiti*

5.—Position of rostral setae variable; body length 678–782 μ .... *P. nasuta*

—Rostral setae arranged longitudinally; body length 626–682 μ .... *P. nasuta D*

V. ALPHABETICAL LIST OF ABBREVIATIONS[5]

a: antelateral seta

ap_{1-3}: apodemata 1-3

b', *b''*: border of circumtrochanter

*ba. LS**: border of *LS*

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[5] New abbreviations are marked with an asterisk.

ba. rt: border of teglum
b. pm: posterior border of mentum
b. rt: border of rostral tectum
c_{1-3}: gastronotic setae of segment *C*
ci: internal border of b' and b''
*CL**: CLAPARÈDE's organ
d_{1-2}, *dp*: gastronotic setae of segment *D*
e: palpal spine
e_1: coxal minute spine or gastronotic seta of segment *E*
*es**: ceratiform cuticular basal projection for it''
ev: phragma for tendon *ts*
exa: anterior exobothridial seta
exp: posterior exobothridial seta
F: femur
f_{1-2}: gastronotic setae of segment *F*
G: genu
g_1: gland of leg I
ga: aspidosomal gland
gla: lateroabdominal gland
mn: mentum (=*H*)
h_{1-4}: gastronotic setae
ht: hook-like projection of basal part of apotele
ia, *ih*, *im*: lyrifissures of gastronotic region
in: interlamellar seta
it: iteral seta
l: lateral seta
le: lamellar seta
LS: labrum
m: monotrop seta of leg I
m_{1-2}: setae of mentum
nlbo: lateral nervure of aspidosoma
p: proral seta
pl: primilateral seta
pg: genual pore
PS: pseudoanal segment
pv: primiventral seta
PY: pygidium
ro: rostral seta
s: subunguinal seta
*SO**: protective scale for *CL*
ss: sensillus
t: tendon
TCX: chitinous triangular zone of podocephalic region
ti: inferior tendon
TR: tarsus
R: trochanter
u: unguinal seta
v', v'': ventral setae
Δ', Δ'': trochanteral dents for articulation
ω: tarsal solenidion
φ: tibial solenidion
σ: genual solenidion
ε: famulus of tarsus
ζ: eupathidion of tarsus
( ): paired setae
′, ″: pro- and retrolateral
1*a*, 1*b*, 2*a*, 3*a*, 3*b*: epimeral setae or coxisternal setae

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摘要

鈴木恵一（東京都足立区千住5-88）：キョジンダニ（ダニ目：隠気門亜目）の後胚子発生．（1）幼生期．

隠気門類の幼若期にあるダニと成体とでは別種を思われるほど形態的差異が著しく，高等なものほど形態上の変化が激しいという傾向がある．これに対し，下等隠気門類では，本研究のキョジンダニの如く差異のあまり目立たないものも見られる．キョジンダニは，Aoki (1960) が *Apolohmannia* として記載したものであるが，その後 Aoki and Fujikawa (1969) により *Perlohmannia* に移された経緯を持つ．本属のダニは5種，1型（地理的差異？）が知られており，幼若期の詳細な形態的研究は Grandjean (1958, 1961) が，*P. coiffaiti*, *P. dissimilis* について行ったものがある．

本研究第1報では，キョジンダニの幼生とこれら2種のそれとの比較形態学的研究を行った．その結果，本性が既知の2種の幼生と著しい差異のあることがわかった．つまり，本種には（1）後体部背面の節片化した板状構造 PY のないこと，（2）pseudoanal setae のないこと，（3）後体部毛 h_1 が鉤状をしておらず，単子葉類の葉に似た形態をしていること，（4）触肢毛式，先脚毛式が異なること，（5）第2歩脚，第3歩脚の跗節には舳毛 (p) がない．などであり，成体での差異の少ないことにくらべ，幼生期では種々の点で異なっている．